

Letter to the Editor

Aerosol shield and tent for health-care workers' protection during the coronavirus disease 2019 pandemic

Dear Editor,

For health-care workers performing aerosol-generating procedures (AGPs) on patients with coronavirus disease 2019 (COVID-19), airborne personal protective equipment (PPE) and precautions are required. As supplies of PPE have been depleted during the COVID-19 pandemic, new reusable types of equipment are needed to ensure protection. In response to this situation, previous reports have proposed an "Aerosol Box",^{1–3} which is intended to protect health-care workers while performing AGPs. The original Aerosol Box designed by Dr Hsien Yung Lai consisted of a transparent plastic cube covering a patient's head, with two access ports for the clinician's arms.⁴

Canelli *et al.*¹ reported that while the box does protect clinicians during intubation, it restricts hand movements during the airway procedure. Although clinicians and companies have made modifications to the original model to optimize operator ergonomics,³ in our experience with the Aerosol Box and training manikins, we also had difficulties due to limited clinician range of motion while performing airway procedures. Therefore, we made further modifications to the original model, resulting in a new design that is more of a "shield and tent" than a box. This new equipment consists of a transparent plastic shield with a sloping angled surface and a plastic drape attached to the top and side edges

of the shield. The drape incorporates two linear ports—one on each side—through which the clinician's arms can pass to perform AGPs. The ports are made at the position shown in the Figure 1A, by making a cut in the drape with scissors.

The shield is made of transparent polyethylene terephthalate (PET) sheeting. The dimensions of the shield are provided in Figure 1B. The PET shield is bent at an angle of 60° via heat processing. Because the shield is made of a single sheet of PET, it exhibits high strength. Furthermore, PET is not damaged by alcohol disinfection and is reusable after decontamination with a cleansing agent. After use of the equipment, the surface of the shield is cleaned with standard disinfectants approved by the U.S. Environmental Protection Agency for use against emerging viral pathogens, such as quaternary ammonium or ethyl alcohol.⁵ The plastic drape is disposable and can be replaced with a plastic garbage bag. We actually used transparent garbage bags with a capacity of 90 L (width 900 mm, height 1,000 mm). We recommend a drape of similar size to fully cover the patient's face and his/her surroundings.

Through our experience in patients with COVID-19, it became evident that this equipment has high versatility and applicability. Further, we have found that the shield and tent do not impede airway procedures. Using the equipment, we have performed AGPs such as intubation, extubation, and

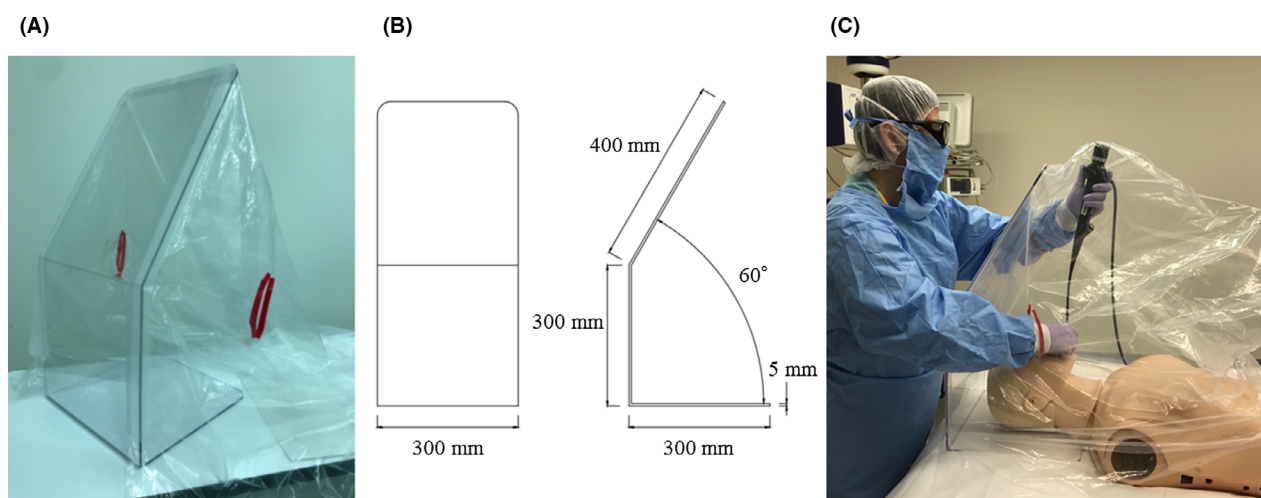


Fig. 1. The aerosol shield and tent. (A) The aerosol shield and tent with two access ports. (B) Dimensions of the shield. (C) Bronchoscopy with the aerosol shield and tent.

the collection of aspirates for reverse transcription-polymerase chain reaction assays without disruption of the procedure or diminished patient safety. In addition, the shield and tent provide sufficient space for operating larger airway equipment such as bronchoscopy, as shown in Figure 1C. It should be noted that we performed bronchoscopy in patients with suspicion of persistent atelectasis and observed no technical issues.

Another advantage is that the plastic drape attached to the shield provides sufficient room to protect assisting staff positioned in front of the patient. Maneuvers to support the clinician during the airway procedure can be performed by introducing the assistant's hand through the drape. Moreover, this equipment has a simpler structure and is of lighter weight than the original Aerosol Box, thereby improving its portability and ease of installation. Finally, this equipment may also be useful for cardiopulmonary resuscitation and intrahospital transport of nonventilated patients with COVID-19.

As previous reports have suggested, the equipment should be used as an additional measure to supplement existing airborne PPE precautions, and not as an alternative to appropriate PPE.^{1–3,6} However, our shield and tent model could provide valuable additional protection to health-care providers in resource-limited settings.

DISCLOSURE

Approval of the research protocol: N/A.

Informed consent: N/A.

Registry and the registration no. of the study/trial: N/A.

Animal studies: N/A.

Conflict of interest: Authors declare no Conflict of Interests for this article.

Yukari Goto,¹  Takanori Yamamoto,¹ and Masayuki Ozaki² 

¹Department of Emergency and Critical Care, Nagoya University Hospital, Nagoya, Japan, and ²Department of Emergency and Critical Care Medicine, Komaki City Hospital, Komaki, Japan
E-mail: gotoyu@med.nagya-u.ac.jp

REFERENCES

- 1 Canelli R, Connor CW, Gonzalez M, Nozari A, Ortega R. Barrier enclosure during endotracheal intubation. *N. Engl. J. Med.* 2020; 382: 1957–8.
- 2 Leyva Moraga FA, Leyva Moraga E, Leyva Moraga F, *et al.* Aerosol box, an operating room security measure in COVID-19 pandemic. *World J. Surg.* 2020; 44: 2049–50.
- 3 Malik JS, Jenner C, Ward PA. Maximising application of the Aerosol Box in protecting healthcare workers during the covid-19 pandemic. *Anaesthesia* 2020; 75: 974–5.
- 4 Lai HY. Aerosol box-design. 2020. [cited 06 May 2020]. Available from: <https://sites.google.com/view/aerosolbox/design>.
- 5 United States Environmental Protection Agency. List N: Disinfectants for Use Against SARS-CoV-2 (COVID-19). [cited 9 Jun 2020]. Available from: <https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2-covid-19>.
- 6 Kearsley R. Intubation boxes for managing the airway in patients with COVID-19. *Anaesthesia* 2020; 75: 969.